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ABSTRACT

Based on the idea that children learn language and mathematics in much the same way, and that they can learn both simultaneously, the five sections of this journal present teaching ideas addressing various aspects of this process. The first section discusses the "language of math" with reference to both the child and the teacher. The integration of math and the language program is treated in the second section, emphasizing ways in which teachers can create and exploit experiences to add to children's mathematical vocabulary. The third section presents several classroom projects designed to teach children about weight and length measurement, vital statistics, and time. Further classroom ideas are included in the fourth section, which focuses on math and writing. The final section addresses math and reading, claiming that the former begins with the latter. Books useful for introducing the concepts of size, shape, counting, time, and multiplication and cooking are recommended. (JD)

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P.E.N.

PRIMARY ENGLISH NOTES . . .

Classroom Notes . . . from the Primary English Teaching Association

LANGUAGE LEARNING while LEARNING MATHS

Problems

Why
do we
have to work
problems out?
I do not particularly
want to know
how many
of 702 apples
fit into 54 cases . . .
Besides,
John the apple picker
should work
that problem out
himself.

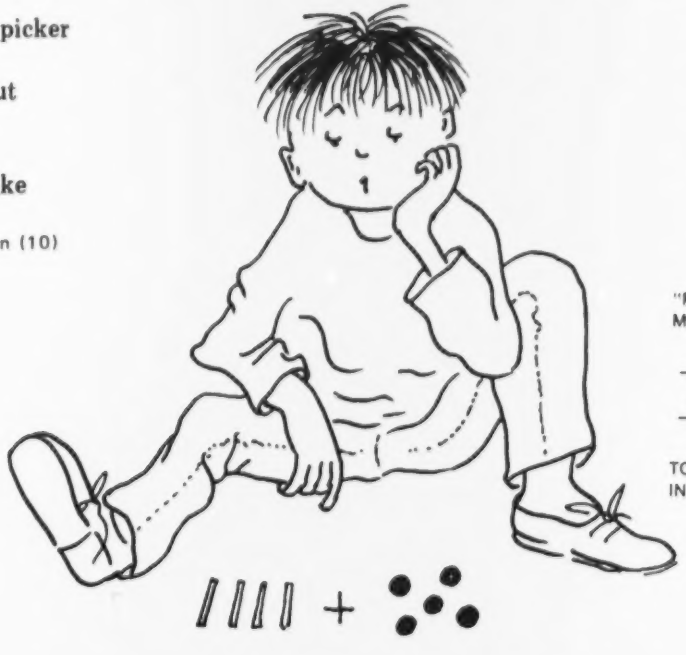
I do not even like
apples!

Allyson (10)

All those numbers

All those numbers
jumbled up in my head
like scrambled eggs
in a pot . . .
In the left ear,
out the right . . .
Jumbled up in my head
all those numbers . . .

Prue (10)



Maths

So many figures there
I do not know
from odd
to even!
I hate those ones
that they call
PUZZLES.
Exercise A,
Page 68 . . .
Mr Williams . . .
17 cents, 13 cents,
A friend . . .
24 red,
18 blue, 15 green . . .
Who wants
a dozen boxes of
balloons?

Liza (11)

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

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Children learn language and mathematics in much the same way, and they can go on learning each while learning the other.

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The Child

The Beginning

When are children ready to use mathematical language? They certainly won't wait till age five! Long before then, they explore, manipulate and control the space around them — its objects and relationships in all their immense variety. And while this is happening they also learn the language that describes what they are seeing, thinking, doing ...
The cup is full, half-full or empty.
The door is near or far, open or closed.
The car goes fast, but I walk slowly.
There are three bears — a great big bear, a middle-sized bear and a little baby bear.
All this language expresses early mathematical concepts.

'One, two, buckle my shoe
Three, four, knock at the door'
— so chants the pre-schooler, totally unaware that s/he is having a maths lesson. Fingers and toes are there to be played with, used for picking up things or — for counting. Everything's *integrated* at this stage — birthdays and candles and slices of cake, picture books about *Millions of Cats*, stories of *Seven Little Kids* or *Five Chinese Brothers* — all add to the child's mathematical vocabulary. There's so much for the school to build on!

'When I'm five . . .'

School ... and suddenly s/he's faced with Maths. If lucky, this child will meet teachers who communicate the idea that mathematics is always a means to an end, that it helps you to do things — like buying ice cream, sharing goodies, building a cubby, learning music...

S/he'll be told that mathematics is part of cooking, wallpapering, storekeeping, dressmaking, magazine editing, engineering and driving. And if really lucky, s/he'll see in practice that mathematics is about real problems and pays off in useful solutions — when Dad fits linoleum tiles precisely on a kitchen floor, when Mum adapts recipes to serve more than the book suggests, or when they calculate how much petrol they'll need for a trip or the right amount of material to make new curtains.

... Maths helps people every day through a multitude of ordinary tasks.

Language Is the Tool

In the right kind of classroom the child finds that when we do things we talk about them, that language is the tool which enables children and adults alike to talk about problems as a necessary part of the process of solving them. And then the child easily adds new words to the language already known — new language that will help to produce mathematical literacy ... or 'numeracy'.

The Teacher

Does Your Maths Language Rate an A?

Some teachers who frown on sloppy, inaccurate expressions in children's speech and writing are unwittingly careless about their own mathematical language. They may not, for instance, have taken the trouble to master the terms introduced by modern approaches to maths. There are good reasons for adopting these in the interests of their precision and their acceptance at all later educational levels. So why not, to give a simple instance, read the number sentence or equation 7 — 3 = 4 as 'Seven minus three equals four.' instead of using the old 'Seven take away three leaves four.'? If we update our terminology then our confident use of it in the classroom will soon be taken up by the children.

Show Children How to Read Number Sentences

To produce the desired, natural interweaving of maths and language the teacher's basic approach from the beginning is to lead the children into 'hands on' activities, manipulating real-world objects and relationships. In addition, the teacher can from time to time show middle and upper primary children that they can *read* a number sentence, e.g.

8 + 4 = 12
Eight plus four equals twelve.

A great deal can easily be discussed about this 'translation': number sentences, like English sentences, read from left to right; + means 'plus'; = means 'equals'; other synonyms for 'plus' are 'and' or 'added to', and for 'equals' are 'is' or 'adds up to'; there are the same number of things on one side of the = sign as on the other, so the whole is an 'equation'; 'eight' is a noun, 'equals' is a verb; etc.

Depending on the level of the children, such sentences can gradually be made more exacting:

19 — 7 = 12
Nineteen minus seven equals twelve.

3 x 4 = 12
Three times four equals twelve.

24 ÷ 2 = 12
Twenty-four divided by two equals twelve.

A teacher will have no difficulty creating any number of variations on these, with increasing complexity. More important, *the children can themselves create examples*, which can be orally read, silently read or written out, working from the number sentences to English sentences, or vice versa. In short, maths, like English, can be spoken, read or written.

Don't Make Maths Seem Dreary

Some teachers are heard to say, 'If you kids don't behave you'll have to do some maths exercises!' That's as certain to identify maths with dreary punishment as the setting of 'Fifty lines!' for misbehaviour gives writing a bad name.

Maths need not be dreary. Many children have found it as interesting as language — and it could be so for all children, given the right approach.

Don't Teach Maths in Isolation

Why is maths so often taught in isolation — so seldom integrated with other learning? Perhaps because many of us found it an agony in our schooldays, and so we carry on with traditional attitudes. ('Let's get the agony over and then we can do something interesting.')

Why, when society is shot through with number, space and measurement problems, do we keep maths in a separate compartment instead of frequently linking it with other activities?

Finding Maths Just About Everywhere

Simply by a change of attitude a teacher can begin to see the natural penetration of life by numbers. Then a natural integration of maths with the rest of the program becomes possible and a natural interweaving of maths and language.

For example, the day can begin with 'How many pupils are present? How many boys/girls are away? So how many more girls are present than boys?' ... and other experiences will keep cropping up all day, including opportunities for number *play*.

In particular, experiences can be exploited which enable the teacher to add to the children's mathematical vocabulary. This shared and growing vocabulary is the base on which more and more complex maths problems are pondered, discussed, figured out, solved.

Valuable in Learning

Talk which is of the 'mere chatter' kind does not get far in solving a real life maths problem. There needs to be specific measurement and recording, for instance; and careful calculation with talking and writing *to a purpose* integrated with the calculating... Learning — the child's grasp of how-to-learn — is reinforced by both the language and mathematical operations.

Inter-disciplinary Approaches

In some schools in recent years maths is smoothly integrated with science and/or other subject areas.

For example, when studying graphing, the children might collect scientific data and construct a line, bar or circle graph. They might, perhaps, graph the growth pattern of a plant or classroom pet. This combination of maths and science not only provides them with a technique for recording data but might lead to the keeping of a diary of activities. From there it's a short step to writing stories and poems — experience-based or imaginative. At best this sequence will be a natural unfolding of the children's interest and not a teacher-dictated 'theme'.

All the time as ideas are explored, vocabulary extended, and various registers of language tried out, pupils are growing more confident in both their handling of language and their ability to solve problems.

Of course time is still allocated to specific maths lessons. They are as necessary as are special demonstration or revision lessons in spelling, punctuation or syntax. It's just that the teacher doesn't stop there. Children in these classrooms are as likely to be talking and writing about mathematical problems and experiences as they are about ghosts or holidays or sport.

Versatility of Mathematical Materials

Mathematical materials are a vital aid in exploring language. Used correctly, cuisenaire rods, for instance, continually reinforce reading and writing. Take the three main steps of a lesson with rods:
First: the children *build* their number sentences.
Second: they *describe orally* what they've done. And as they look at the solid representation of their number sentences they read from left to right and from top to bottom exactly the way they do in reading a book.
Third: they *write* the number sentence.
It would be a bold teacher who would claim that this was pure mathematics and not also a language lesson.

In some schools with a high number of migrant children, both classroom and E.S.L. teachers have found materials ideal for teaching language and maths together. The child with a limited English vocabulary can copy what the other children are doing by picking up the correctly coloured piece mentioned by the teacher. Thus s/he relates the action to the spoken word.

Start Some Fun Files

Make up some amusing maths questions and get the children to write these on individual file or systems cards. (Marvellous for reinforcing punctuation skills.)
Some examples —
How many times does Helen's heart beat in 10 seconds? How many blades of grass in 100 square centimetres? How many toes in the classroom? How many bricks make a classroom wall? How far would ten Smarties (or Lifesavers) reach if laid side by side? What about one thousand? How many steps does it take to cross the classroom?

(N.B. Answers can be given in both teacher and pupil steps; with older children, an average can be worked out.)
As pupils (working individually or in pairs) find out the answers, they can be written on the backs of the cards, which are then filed for further use.

From time to time suggest using these important facts in stories. If necessary prepare a few starters,e.g.
Imagine if you can, three hundred bright green toes. Let me tell you how it happened ...
Usually it takes me twenty steps to cross our classroom, but on the day the gorilla arrived ...
Encourage the children to add to the file at any time and to dip into it regularly for fresh ideas.

Vital Statistics

Have pupils measure the various parts of their own and/or their friends' bodies and record the findings on cards. Suggestions: height, arm length, elbow to finger, height of belly button from floor, length of foot, distance around neck, wrist, ankle, etc.
Lead into sentences based on comparisons, e.g. George's arm is longer than his foot.
Angela's thumb is shorter than her index finger.

Past, Present and Future

Ask the children to collect from home their measurements of weight and length at birth. Help them to compare these with their present measurements and suggest they predict what they think they'll be at ages 18 and 30 — and 99. Follow up with an article or poem titled, *How I've changed!*

Did You Know This?

A variation on the statistic-collecting theme is to set the children free to explore a variety of questions (invented in a class brainstorming session) and then to use these facts in an interesting book titled *Guess What!* or *Did You Know This?* It could include such fascinating items as —
Robin's fingernail is ... millmetres wide.
Terry lives ... kilometres from school.
Tracey says 10 cents weighs ...
Lisa's mother's car holds ... litres of petrol.
Bob drinks ... litres of milk a week.

How Long Does It Take?

Borrow a stop watch and let the children find out how long it takes to tie both pairs of shoelaces, button a raincoat, hop across the room, drink a glass of water, add ten numerals ...
Enter the findings on cards for the Fun File and use in stories and poems.

What Does It Weigh?

Set up a balance and ask pupils for suggestions on items they would like to weigh. As a language follow-up, write sentences using the comparatives *heavier* and *lighter*, e.g.

A pencil is lighter than a stapler.

A flower pot is heavier than a box of paper clips.
Try pasting these inside a home-made book with bright illustrations beside each fact.

Hold an Aeronautics Display

Make a specified variety of paper darts so as to develop measuring skills. Set the class to work hunting for books which tell of the development of gliders and aeroplanes and start a class book which records the children's findings. Write appropriate words and sentences on the paper darts and give permission to set them zooming around classroom and playground.

And a Transport Tally

Set up a check point at the school gate and roster pupils to count how many trucks, card, motorbikes, etc. pass the school, hour by hour, in one day. Make graphs, charts and lists and write reports to share with other classes.

The Story That Grew!

Offer your pupils open number sequences such as

3 + 4 = 7 − 3 =
9 + 20 + ? = 150

Once they've found the answers ask them to invent a story based on one of them.
e.g. Take 3 + 4 = The first draft could read:
Mary walked three blocks and then she walked four more blocks. She walked seven altogether.
After this first attempt, ask for more detail and imagination. You might get this:
Mary went shopping for her mother. On the way she went three blocks down High Street. Then she turned into Station Street and walked four more blocks. At last she got to the supermarket. She'd walked seven blocks — and her feet were certainly sore!

If pupils are still enjoying this 'writing based on maths', suggest a third version. Make it more elaborate and creative by tossing in some questions:
How many people did she meet? What if she ran into a monster or a spaceman? Did she remember what she had to buy when she got there?

Put the number sentence and all versions of the story in a booklet and label it, *The Story That Grew!* Hand it around for free reading and comment.

What Really Happened?

Working with the children, construct a series of maths equations that include symbols. *

e.g 36 + 30 = □
□ ÷ 30 = ○ with a remainder of △
△ ÷ 2 = 3

After solving the problem, pupils write a story about it.
e.g. *One day Sally bought thirty-six jelly beans and Mario bought thirty. Altogether they had sixty-six jelly beans. There were thirty children in the class, so they gave every girl and boy two jelly beans. There were six left over, so the class teacher and the principal were given three each.*

From there develop a more interesting story, or use as a basis for an unscripted play.

*N.B. With this one, if you think your class is likely to be confused by originally conceived symbols, stick to the familiar ones found in their Maths book.

Make a Book

Try some shape books. Start with —
Round is — a button, a door knob, a pancake ...
and add lavish illustrations.* Move on to
Square is ... , Oblong is ...

Pick a number: 3 or 13? Ask pupils to make a book about any particular number which appeals to them. A book about the number 13 would, for instance, include all the combinations that make up 13 and the history of its name, plus information about any superstitions applied to it. Round it off with poems and stories involving thirteen objects or telling about what happened on 'Friday the Thirteenth'.

Nursery rhyme problems. Suggest a class book full of problems based on familiar nursery rhymes, e.g.

How many men went to sea in a boat? Add this number to the number of bags of wool owned by the black sheep. Now add the number of blind mice. How many does that make altogether?
Brightly illustrated, this could make a welcome gift for any Infants class or a children's hospital.

Make a class telephone book. Motivate interest in numbers and names by looking up addresses and phone numbers for all class members, e.g. Divide the children into teams so they can take turns doing this. Include any other people or firms of importance to the class, e.g. the bus company, museum, railway station, etc., as well as the usual emergency ones for fire, police, ambulance ...
Set out, written and illustrated by pupils, this is an excellent project for reinforcing alphabetical and number skills.

Pure invention. Invent stories about:

Odd Oliver who only ever eats 3 sandwiches or 5 potatoes and won't get on a No. 2 bus.
Then try some about *Even Stephen* who buys everything in twos — or fours or eights!
Hidden Treasure. Start with a map and write about pirates and hundreds of gold coins.
The Muddled Shopkeeper. What happens when you can't count change correctly?
Thousands of Guinea Pigs. Obviously a story about multiplication.
Where's My Slice? What happens when the person dividing up the cake doesn't calculate correctly?
You've Missed Lunch! A warning about the dreadful consequences of not being able to tell the time.

*For a brilliant extended story about 'Round', by eleven-year old Louisa Jorm, see PETA's 1975-6 Journal, *New English New Ways*, p.37.

Maths Starts with Reading

Often we forget that reading comes first. But what if a child is a poor reader? 'Difficulty with mathematics' may possibly mean 'difficulty with reading'—inability to decipher the language in which problems are expressed. 'Does s/he understand *the words*?' should always be our first thought.

It's important to remind ourselves that our aims in maths lessons are often identical with those set for language lessons: Do the children comprehend what they are reading? In giving answers, do they use logical, correct English? Can they analyse the problems and think, or talk, their way through to a solution?

Once There Was ...

Never spoil a good story by using it as a 'lesson', but at the same time don't be slow to comment on any theme or section in a story which points to an everyday application of maths.

Worth Reading

A few books to look for. Useful at any level.
Size: *Big Dog, Little Dog*, P.D. Eastman (Picture Lion)
Little Old Mrs Pepperpot, A.Proysen (Puffin)
The Borrowers (Series) M. Norton
And don't forget *Gulliver's Travels* and all those stories about giants, dwarfs and seven-league boots.
Shape: *Flat Stanley*, J. Brown (Methuen)
Counting: *Millions of Cats*, W. Gagg (Picture Puffin)
The 500 Hats of Bartholomew Gubbins, Dr. Seuss (Collins); *Fourteen Rats and a Rat-Catcher*, T. Cole (Puffin); *The Story About Ping*, M. Flack (Picture Puffin). He has a mother, a father, 2 sisters, 3 brothers, 11 aunts, 7 uncles and 42 cousins!
Time: *Benjamin's 365 Birthdays*, J. & R. Barrett (Puffin); *The Thirteen Clocks*, J. Thurber (Puffin)
And don't forget *Sleeping Beauty* and *Rip Van Winkle!*
Multiplication and cooking: *The Piemakers*, H. Cresswell; *Floury Fingers*, C. Hinde (both Puffin).
For a really beautiful collection which brings out language issues, see *Nuffield Maths 5-11*, Bronto Books Sets A - D (Longman Cheshire).

With older pupils, look for books about journeys and voyages and science fiction — especially those featuring rockets and space travel. But also turn back to *Swiss Family Robinson* and *Robinson Crusoe* for reminders about survival skills. And offer *How-To* books such as *The Paper Aeroplane Book*, S. Simon (Puffin), and the *Practical Puffin* Series.

P.S. And of course no child should ever miss out on Carl Sandburg's poem, *Arithmetic*.

P.E.N. #17 was written and illustrated by Pat Edwards in collaboration with A. G. Aitkin, author of Number Mastery: A Set of Maths Workbooks (Jacaranda), co-author of The Parents' Guide to Coloured Rod Mathematics (distributed by E. D. Yates, P.O. Box 387, Chatswood).

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